Oklahoma Agricultural Experiment Station,

STILLWATER, OKLAHOMA.

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DIRECTIONS FOR USING VACCINE FOR THE PREVENTION OF BLACKLEG IN CATTLE.

INTRODUCTION.

The Experiment Station has published several short articles giving in a brief way the general character of blackleg and describing the best means of preventing the disease, as well as advising such sanitary precautions as seem best to follow under the circumstances. The result is the very general practice of vaccination, stockmen generally recognizing the fact that blackleg can be prevented in this way.

All of the work in connection with the distribution of the vaccine has been kept in the form of records which will be of value as the work progresses. Much of the laboratory work has been done by Mr. F. L. Rector, an assistant in the veterinary department. Those who use the vaccine can very materially add to the general information on the subject by reporting any unusual occurrence noticed in connection with the use of the vaccine.

VACCINE DISTRIBUTED.

In October 1899, the Oklahoma Experiment Station received 1000 doses of vaccine from the Bureau of Animal Industry, U. S. Department of Agriculture, for free distribution to the stockmen of Oklahoma. Previous to this time no effort had been made by the Experiment Station to

give any material assistance in controlling in a systematic way the prevalence of the disease. The inquiries received indicated that blackleg was especially prevalent, and that most stockmen regarded the disease as practically incurable as well as dangerously infective. Usually the letters of inquiry asked for advice as to the best means of disposing of the dead animals and what could be done to prevent the excessive losses from the disease. Those inquiring for a preventive were referred to the Bureau of Animal Industry and the usual advice in regard to burning or burying was given in reference to the disposal of the dead animal.

The small amount of vaccine received was soon distributed and the demand soon became so general that it was thought advisable to undertake to supply it by sending out vaccine prepared by the Experiment Station. Some time and expense was necessary to equip the laboratory for work of this kind, and in addition material had to be secured from which to make the vaccine. Since the work has been started the only available material has been such as was furnished by parties who were losing cattle. In order to secure this diseased meat letters were sent out describing the necessary precautions to be observed in securing meat from animals that had died from blackleg. About one-half of the material received at the laboratory was in such a condition that it had to be destroyed. In many cases it was filled with dirt and sand and in others it had not been sufficiently dried, showing in many cases the effects of decomposition, while in two cases the material proved to be from animals that had not died from black leg. This very uncertain supply of material frequently left the Station without vaccine to fill the requests. This unsatisfactory arrangement was necessary on account of the lack of funds to carry on the work in a more systematic way. The special provisions that have now been made for the distribution of vaccine will enable the Experiment Station to purchase and kill as many animals as will be needed to supply the cattlemen of the Territory with vaccine. This arrangement will place the work on a substantial basis, it will enable the applicant for vaccine to secure it promptly and, in many cases, losses will be prevented that were before unavoidable.

The first vaccine sent out from the Station that had been manufactured in the veterinary laboratory was March 1, 1900. From that time until June 30, 1902, 184,310 doses were sent out. Of this amount 8,735

doses were sent out between March 1, 1900, and June 30, 1900. The following table shows the number of doses and requests by months from July 1, 1900 to June 30, 1902.

DISTRIBUTION OF BLACKLEG VACCINE.

JULY 1, 1900, TO JUNE 30, 1901			JULY 1, 1901, TO JUNE 30, 1902		
Month	Number of Requests	Doses	Month	Number of Requests	Doses
July	3	120	July	42	4965
August	17	685	August	22	1990
September	26	2425	September	59	7460
October	74	7070	October	241	23570
November	69	7415	November	307	22135
December	63	5935	December	148	12530
January	31	4215	January	103	8500
February	51	4645	February	92	4270
March	58	4505	March	142	10500
April	57	5610	April	165	11265
May	69	6030	May	152	11605
June	43	3300	June	79	6100
	561	51955		1552	123620

From July 1, 1902 to May 1, 1903, 92,855 doses have been sent out, making a total of 277,165 doses that have been furnished without any expense whatever to the parties who have used the vaccine.

HOW TO GET VACCINE.

Considering the general prevalence of the disease and the efficiency of vaccination in preventing blackleg it is evident that the total amount of loss that has been prevented is considerable. The benefit to stockmen has been of so substantial a character that arrangements have been perfected that will enable the Experiment Station to continue the manufacture and distribution of all the vaccine needed by the stockmen of Oklahoma.

The policy of the Station in sending out vaccine has been to supply all the vaccine needed on receipt of a request from the party who intended to use the vaccine. Some have undoubtedly taken advantage of this liberal method and secured vaccine for commercial purposes, but this has been a comparatively rare occurrence. The accommodation to the man who wants a few doses of vaccine and who will use it as soon as he can get it is enough to outweigh the few cases where deception is practiced. No special form of application is required. A card or letter stating the number of doses wanted, that the applicant is a citizen of

Oklahoma, and that the vaccine is for use on cattle owned by him, sent to the Experiment Station will secure all the vaccine needed and directions for its use. Records are kept of all requests and vaccine sent out, and at some future time a printed list of questions will be sent to all who have received vaccine, asking for information in regard to the various questions concerning the prevention and controlling the disease.

DISTRIBUTION AND NATURE OF THE DISEASE.

Blackleg is found to some extent in nearly all countries of the world. Temperature and altitude do not seem to be very important in limiting the disease as it is very common in the northern states and in high altitudes. The distribution of the disease in the United States is becoming very well known through the systematic efforts that are being made by the government and the various states to prevent the great amount of loss which occurs every year. Some of the Atlantic and Gulf states are practically, if not entirely free from the disease, while the states immediately west of the Mississippi river are generally infected, especially Texas, Oklahoma and Indian Territories, Kansas, Nebraska, Colorado and North and South Dakota. In the states named the per cent of infected counties varies from 46 in Texas to 100 in Oklahoma. Applications on file show that the disease is present in every county in Oklahoma, though more especially in the southern and western counties.

Cattle over three years of age are practically immune to blackleg, while younger and rapidly growing cattle are very susceptible. In some localities the general opinion prevails that calves under six months of age will not have the disease. This is a mistake as numerous letters received will show. There are many cases of the disease in young calves and unmistakable cases are occasionally reported in three and four year-olds. Range cattle are not as susceptible as well-bred animals and this may explain the fact that blackleg is more common among well-bred animals than on ranges where no attention is given to the improvement of the stock. The disease is also more common, in proportion to the number of animals, in the agricultural portions of the Territory than in the portions devoted entirely to range purposes.

The germ that causes blackleg is a short rod-shaped body, about one three-thousandth of an inch in length. They are always found in large

numbers in the bloody fluid and black muscle at the seat of the disease and for this reason the material should be buried and not allowed to get scattered over a pasture. The germ will grow only when oxygen is kept from it and the growth is always accompanied by gas production. Numerous experiments have been conducted to determine the length of time the germ will live under varying conditions, the results always showing the germ to be very resistant, principally on account of the spores that are formed. It is practically impossible to duplicate, in an experimental way, the conditions existing in pastures and to which cattle are exposed. Experiments conducted in the laboratory show that the germ is killed in twenty to twenty-two days when exposed to direct sunlight. The same results would occur in pasturcs if all of the infection could be acted on directly by the light. The germ is not easily killed by either heat or chemicals and the cold of winter has no effect whatever in ridding a pasture of infection. One of the surest means of freeing pastures of infection is to burn them in the early spring. This applies not only to blackleg infection but to any infection that may be present. A two per sent solution of carbolic acid will not kill the germ in dried material in less than fifteen to twenty hours. For disinfecting purposes a five to eight per cent solution of carbolic acid should be used or a solution of corrosive sublimate one to one thousand. Lime thoroughly applied to an infected area, as where an animal has died in the pasture or barn, will generally kill the infection. The temperature of boiling water acting for twenty to twenty-five minutes is necessary to destroy the germ in fresh material while the dried virus will not be killed by the same temperature in six hours, the difference being caused by the formation of spores in the dried material.

Even though blackleg is one of the most comomn diseases there are some things in connection with it that are not easily explained or very well understood. The disease has been observed here, in many cases, in pastures where no such disease had been for at least ten years. The question naturally arises as to whether the germ will live for that length of time outside of the body or whether the infection was brought into the pastures in some unknown way. Experiments just referred to indicate that sun light will soon disinfect all material it can reach as small amounts of diseased meat placed in the sun were found to be sterile

in from twenty to twenty-two days. Only twenty-seven days were necessary to kill the germs of anthrax, this being one of the most resistant germs known. The infection that lives for any considerable length of time in pastures must necessarily be protected in some way and it is possible that such conditions as moisture and warmth cause the germ to grow and when brought to the surface of the ground, by either rains or movement of animals over the ground, it is able to produce the disease when, by means of a wound or food, it gains entrance to the body of a susceptible animal.

SYMPTOMS.

The symptoms of blackleg are so characteristic that there need be no mistake made in recognizing the disease. The general symptoms are loss of appetite, dullness and high fever, followed by supension of rumination and general depression. They are not essentially different from the symptoms of any other acute infectious disease. Within a very short time after the first symptoms are noticed there appears a swelling or tumor on some portion of the body. These tumors may occasionally be noticed as the first symptom of the disease, the animal still having a good appetite, looking bright, but lame from the effect of the swelling. The swelling or tumor is the most important feature of the disease and is always associated with lameness when the swelling is on any part of the fore or hind leg. These swellings may be seen on any portion of the body except that part of the limbs below the knee or hock or on the tail. The most common location is on the thigh or shoulder. These tumors are at first hot and painful, but spread rapidly and soon become filled with gas, as can be determined by passing the hand over the swelling when a crackling sound is heard. These tumors frequently increase rapidly in size and may cover a large part of the body in a few hours. After the gas begins to form the tumor is not sensitive to the touch and the skin becomes cool, dry, and parchment-like over the center. Opening the tumor causes no pain but allows the escape of a frothy red liquid which has a disagreeable but characteristic sour, ordor. If the skin is removed from these swollen places the flesh will be found very bloody and black, looking as if badly bruised. Owing to this black and discolored condition of the flesh, which can always be seen if an examination is made, the disease has been called blackleg. The course of the disease varies, but with very few ex-

ceptions proves fatal in from twelve to twenty-four hours after the animal is known to be sick. This time varies however, especially when older cattle are attacked; in this case the disease is in a milder form and the animal may recover.

PREVENTION.

It is well to state at the outset that there is no curative treatment for blackleg. There are occasional cases of the disease that will recover but in the average case of blackleg no favorable results can be expected from any medical treatment. In those cases that do recover the animal is immune to subsequent attacks. All the various methods adopted as a means of prevention may be placed under such sanitary measures as will prevent the spread of the disease and vaccination, the various forms of prevention and treatment commonly employed being generally useless.

Various methods of treatment were practiced both as a means of prevention and as a cure before the process of vaccination was introduced, and these popular remedies are used at present by a great many stockmen. One of the most popular remedies is to bleed from the jugular vein; this is used as a cure as well as a preventive. It is of no value whatever as a cure and of very doubtful value as a means of prevention. 'Nerving' is a remedy that is practiced by a great many; this consists in cutting a small artery in the back part of the foot and allowing blood to escape. Setoning is practiced to some extent and consists in introducing a piece of leather, rope or poke root under the skin, in fact anything that will cause suppuration and a running sore. When the nature of the disease is understood the uselessness of such methods will be seen. The general practice of such methods as named above was very common before the process of vaccination came into general use. Cutting and roweling the animal only increases the chances for infection through the wounds made and amounts to nothing whatever as a cure or a preventive. The Experiment Station has no remedies to offer as a cure because practical experience has shown that the disease is almost invariably fatal. A great many want to know if vaccination is a cure, but we do not believe that it has any value whatever except to prevent the disease. If a remedy could be found that would cure fifty per cent of the

cases it would be no argument for its use to the exclusion of vaccination. Available statistics on the matter show that where vaccination is not practiced the loss is above three and one-half per cent while after vaccination it is less than one-half per cent.

The manner of disposing of dead animals is to be considered as one of the important things in controlling the disease. There are very few diseases with which the stockman and farmer are so familiar as they are with blackleg; its general distribution, the class of cattle affected and the well marked symptoms combine to make it one of the easiest recognized. But in most cases all fail to appreciate the fact that the disease may become scattered over a pasture or farm by allowing a carcass to remain on the surface of the ground. There is no necessity of opening the animal and the skin should never be removed, on the contrary either bury or burn the animal where found if possible. Burying is the most practical way of disposing of the body as it frequently happens there is not wood enough available to burn the animal. The carcass should be buried at least four feet below the surface and all soil, bedding, etc. that is soiled with the blood should be placed in the pit with the body. It is of the greatest importance that the stockman should recognize the fact that any of the flesh or blood of the animal is infected and while it may not cause any immediate loss it may be the cause of considerable loss in the future. Opening the tumor before the animal dies should not be practiced as the animal will then scatter the infection as long as it can move about the pasture.

Article 1, chapter 2, session laws of Oklahoma, 1899, provides "That it shall be the duty of the owners of any swine or other domestic animals dying from cholera or other diseases, within twenty-four hours after their death, to cause the carcasses of such animals to be buried or burned up" and provides further that "any person violating the provisions of this Act shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not to exceed $50.00, or be imprisoned in the county jail not more than 30 days."

VACCINATION.

There is considerable interest attached to the history and development of vaccination in this particular disease as it illustrates what may

be done in the way of prevention when every remedy imaginable has failed as a cure. Arloing, Cornevin and Thomas were the first to demonstrate that animals may be protected by inoculating them with a weakened virus obtained from animals that had died from blackleg. There is no other disease of either man or animals where vaccination is so uniformly successful as a preventive measure as is the case with blackleg. The per cent of animals taking the disease after vaccination is less than it is in small pox in man after vaccination, yet there is no disease where individual succeptibility varies as greatly. In some instances the dose of vaccine usually given has been known to prove fatal because the animal was so susceptible and in other cases the usual dose has failed to protect against the disease because the animal was more resistant than usual.

The vaccine sent out from the Experiment Station is prepared in the laboratory of the veterinary department and is put up in ten and twenty-five dose packages. As stated before, the vaccine is made from the diseased meat secured from animals that have died from blackleg. This meat is dried, pulverized, and then mixed with water, after which it is placed in a hot air oven and exposed to a high temperature for several hours. This weakens the strength of the virus until it can be used as a vaccine and produces no noticeable results after inoculation, while if a small amount of material, before attenuation, was inoculated into an animal it would prove fatal.

The first vaccine prepared was known as double vaccine, and consisted of two vaccines, one a weak virus, made at a very high temperature and the other a stronger virus made at a temperature several degrees lower than the first. The weak virus was used first and in about ten days the stronger virus was injected. This process required the handling of stock twice, which involves a great deal of work on ranges where several hundred head of cattle are to be vaccinated. In order to avoid handling cattle twice the preparation of a single vaccine was undertaken and several years' experience in its use has proven beyond doubt that it is effective and can be administered with one-half the work necessary to use the double vaccine.

The finished vaccine is a brown powder having an odor similar to that noticed coming from the blackleg tumor when opened. To properly administer the vaccine a hypodermic syringe and other pieces of apparatus are necessary, all of the apparatus used being commonly called a

vaccinating outfit. Before the vaccine can be administered it must be mixed with water and all of it that will do so allowed to go into solution. After the powder is treated in this manner it is filtered through a thin layer of absorbent cotton and the fluid that comes through is the material to be used for vaccination. The various steps necessary in preparing and using the vaccine may be enumerated as follows: After you have everything thoroughly cleaned in a five per cent solution of carbolic acid, proceed as follows.

(1) Place in the mortar as many doses of the powder as you have cattle to vaccinate unless there are more than one hundred head, when it will be better to make up a second lot.

(2) Moisten the powder with enough water to make a paste which is thoroughly ground with the pestle, after which add as many cubic centimeters of water (the syringe holds five cubic centimeters) as you have doses of vaccine and then work the mixture thoroughly.

(3) Place a very thin layer of cotton in the funnel and moisten it with water after which pour the fluid containing the vaccine into the funnel and collect the fluid in a clean bottle or glass vessel.

The careful observation of the directions given in the three steps will give the vaccine carefully prepared and ready to be injected into the animal.

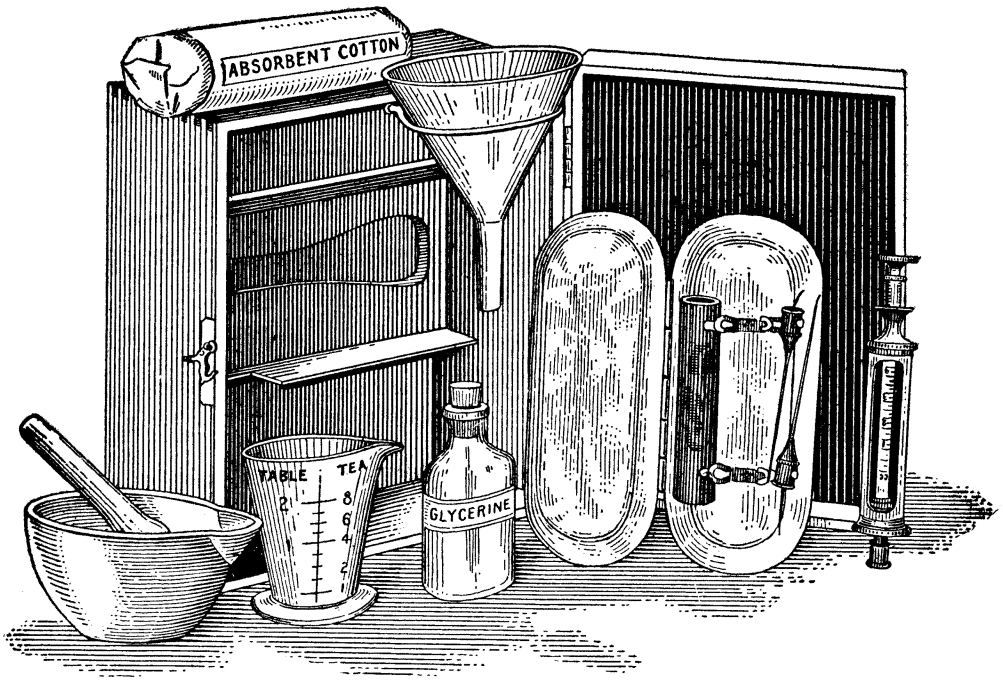

FIGURE 1. VACCINATING OUTFIT.

(Supplied by the Experiment Station for $4.50.)

There are several little details connected with the process of vaccination that are easily overlooked and they may very materially affect the results and it is on account of the failure to observe these little details that some of the bad results following vaccination are due. The liquid, when filtered through the cotton, should be cloudy, but if the layer of cotton is too thick it will be clear and have less of the vaccine in it than when properly filtered; or if the vaccine is filtered before being thoroughly worked in the mortar it will not contain the necessary amount of the virus. After the vaccine is filtered and allowed to stand for a few minutes a sediment is deposited which consists of vaccine. If, without shaking the bottle, the syringe is filled there will be very little vaccine in each dose given while the last from the bottle will probably contain three or four times the necessary amount of vaccine, which in some cases is likely to prove fatal. When possible the vaccine should be prepared at home and taken to the stock pens in small bottles from which it can be drawn with the syringe, being careful to thoroughly shake the bottle before filling the syringe. The vaccine will not keep after it is put into so-

lution, consequently no more vaccine should be made up than is to be used at any one time.

To administer the vaccine, after it has been prepared, a good heavy hypodermic syringe is necessary. Such a syringe is shown in figure two.

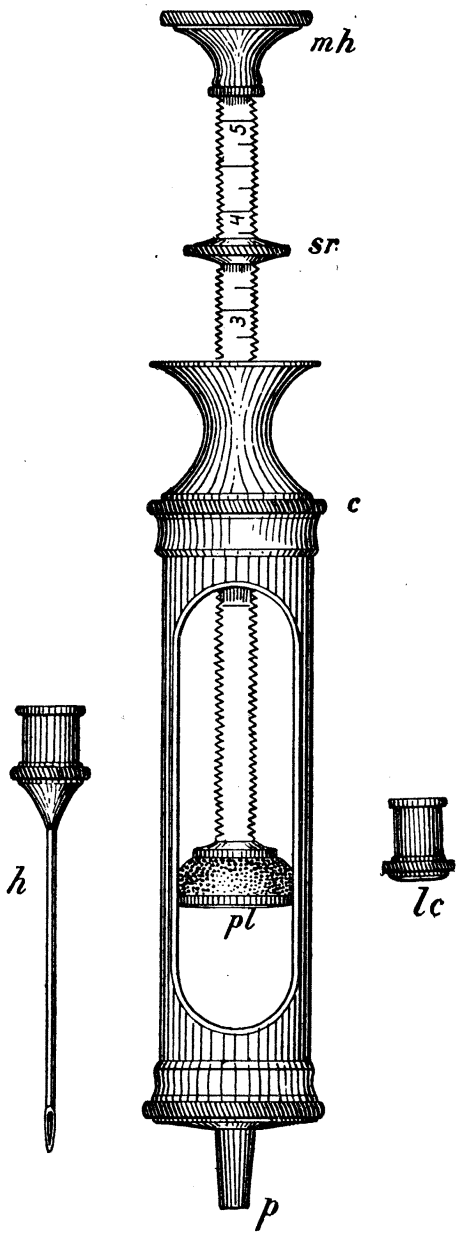

FIGURE 2. HYPODERMIC SYRINGE.

The syringe holds five cubic centimeters (five doses) and the piston is graduated from one to five with finer subdivisions between the figures.

The regulator, or guard on the piston, can be placed at any position and the dose regulated depending on he age of the animal to be vaccinated. For any animal over six months of age the full dose should be given, which is one cubic centimeter, and fractional parts of a dose should be given to young calves depending on their age and development.

When vaccination was first practiced the method was to vaccinate in the end of the tail or the ear where the connective tissue was very dense. This method has been abandoned as it is more difficult to vaccinate in this region than other parts of the body where the skin can be picked up in a fold. The most convenient place to vaccinate is on the side of the neck or shoulder as the skin is thin in this region and the operation is attended

FIGURE 3. VACCINATING.

with less risk to the operator than in any other position. The following directions are sent out with every order of vaccine filled. Part of the process of vaccination has been described but the entire directions are given here in full.

Before the vaccine is prepared all of the utensils, including the syringe, must be cleaned in a five per cent solution of carbolic acid, or they may be boiled for ten minutes. After cleaning remove from the water and dry with a clean towel that has been boiled. Place the vaccine in the porcelain mortar and moisten with a few drops of water which has been allowed to cool. Work the powder with the pestle or glass rod and add slowly as many cubic centimeters of water as you have doses of vac-

cine. The syringe used for vaccinating purposes contains five cubic centimeters and may be used for measuring the water. After the water is added the fluid is thoroughly stirred so as to get as much of the vaccine in solution as possible. To filter the vaccine, place in the funnel a small piece of absorbent cotton, moisten with sterile water and press it down into the funnel. Stir the mixture of vaccine and water and before it has time to settle pour it into the funnel under which you have placed the measuring glass. The fluid should not come through clear, but should be cloudy, and if it is clear the layer of cotton in the funnel is to thick. The object of filtering is to get out the coarse particles to prevent the needle of the syringe from clogging.

When possible the vaccine should be prepared at home and carried to the stock lots in a small bottle from which the vaccine may be drawn with the syringe. If the vaccine is allowed to stand for a short time a sediment will form on the bottom of the bottle, therefore the bottle should be well shaken before the syringe is filled. No more vaccine should be prepared than is to be used at that time as it will not keep in solution.

The syringe holds five cubic centimeters and the piston is graduated from one to five with finer divisions between the figures. The regulator on the piston can be placed at any position. The dose for an animal over six months old is a cubic centimeter, or the distance from one figure to the next, as from four to five. Fractional parts of a dose must be given to younger cattle depending on their age and development. The best place to vaccinate is on the side of the neck or shoulder as the skin is thin in this region. Pass the needle of the syringe through the skin and then adjust the peg of the syringe in the needle and inject the dose which has been measured off on the piston. Withdraw the needle and syringe together and to prevent any of the vaccine escaping through the opening made by the needle press the skin tightly around the needle as it is withdrawn.

After vaccinating, the syringe should be thoroughly washed in a five per cent solution of carbolic acid, carefully dried and the brass wire placed in the needle.

TIME FOR VACCINATING.

There is no special time for vaccinating as it may be done at any season of the year. The disease is much more common during the spring and fall than at other seasons and if the vaccination was attended to during the winter and summer it would very materially lessen the amount of loss. It is best to vaccinate all young animals at least twice and if they are vaccinated before they are six months old then they should be vaccinated three times. Vaccinating a young calf does not give it protection for any great length of time so that it should be vaccinated a second time when six months old. If calves are given a full dose of vaccine at six months and the second vaccination at a year old in almost all cases you will have given the animal perfect protection against any future chance of taking the disease.

A great many inquiries are received asking if it is safe to perform such operations as dehorning, castrating or branding at the time the animal is vaccinated. We have very few replies to direct inquires asking for information in regard to such practices. Persons who have reported the practice of such methods have not found it to be dangerous in any way. The advantage of doing all of the work of this kind at one time is apparent as it saves handling the stock a second time.

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Veterinarian.